

FLASH WRITER VIDEO BOARD
ASSEMBLY INSTRUCTIONS AND
USERS MANUAL

VECTOR GRAPHIC INC.

31364 VIA COLINAS
WESTLAKE VILLAGE, CA 91361

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FLASH WRITER VIDEO BOARD

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INTRODUCTION

THE FLASHWRITER VIDEO BOARD REPRESENTS THE SECOND GENERATION OF MEMORY MAPPED VIDEO DISPLAYS, INCORPORATING MANY IMPROVED FEATURES OVER EXISTING DESIGNS SUCH AS FLICKER FREE UPDATING OF THE SCREEN, SEPARATE SYNC OUTPUTS FOR VIDEO MONITORS REQUIRING IT, MORE CHARACTER ATTRIBUTES CONTROLLING 64 GRAPHIC BLOCK CHARACTERS, VERTICAL AND HORIZONTAL LINE ELEMENTS INDEPENDENT OF CHARACTER OR GRAPHIC ELEMENTS, AND REDUCED INTENSITY FIELDS. IN ADDITION, A KEYBOARD PORT IS PROVIDED ON THE BOARD, ELIMINATING THE NEED FOR A SEPARATE I/O BOARD IN MOST SYSTEMS. THIS PORT IS INDEPENDENTLY ADDRESSABLE, AND THE BOARD IS DESIGNED TO WORK WITH EITHER 8080 OR Z-80 CPU BOARDS.

IN ORDER TO MINIMIZE ANY CHANGES IN EXISTING SOFTWARE THE BOARD IS DESIGNED TO BE UPWARD COMPATIBLE WITH THE VDM-1 WITH THE EXCEPTION OF THE RARELY USED HARDWARE SCROLL FEATURE. A BLOCK OF MEMORY ON THE BOARD, TYPICALLY FROM D000-D7FF, CONTROLS THE CHARACTER AND GRAPHIC ELEMENTS GENERATED ON THE SCREEN. THE FIRST 1K BYTES OF THE MEMORY FROM D000-D3FF CONTAIN THE CHARACTER OR GRAPHIC ELEMENT CODE AND THE REVERSE VIDEO FLAG. THE ORGANIZATION IS AS 16 LINES OF 64 CHARACTERS WITH THE TOP LEFT HAND CHARACTER AT D000, PROGRESSING FROM LEFT TO RIGHT, TOP TO BOTTOM IN MEMORY. EXACTLY 1K HIGHER IN MEMORY IS ANOTHER BLOCK OF MEMORY CONTROLLING THE OTHER CHARACTER ATTRIBUTES, BUT ONLY FOUR BITS OF EACH MEMORY LOCATION IS UTILIZED. THE ON BOARD MEMORY THEREFORE APPEARS TO THE CPU AS A 2K BLOCK OF 8 BITS, WHILE TO THE VIDEO CIRCUITRY IT APPEARS AS A 1K BLOCK OF 12 BITS. IN ORDER TO RETAIN COMPATIBILITY WITH EXISTING SOFTWARE WHICH DOES NOT MAKE USE OF THE ENHANCED FEATURES, ALL THAT IS REQUIRED IS THAT THE UPPER PORTION OF MEMORY BE CLEARED OR SET TO 20H INITIALLY. THIS USUALLY REQUIRES CHANGING ONLY ONE BYTE IN THE VIDEO DRIVER SOFTWARE. ALTERNATIVELY, THE FOUR MEMORY CHIPS CONTROLLING THE CHARACTER ATTRIBUTES CAN BE REPLACED WITH JUMPER WIRES, COMPLETELY DISABLING THIS FEATURE. THE SOFTWARE SUPPLIED IN THE APPENDIX INCLUDES A SIMPLE VIDEO DRIVER WHICH PROVIDES TELETYPE SIMULATION, AND A MORE ELABORATE VERSION PROVIDING SIMULTANEOUS SCROLLING AND WRITING OF CHARACTER AND ATTRIBUTE FIELDS WITH CONTROL SEQUENCES COMPATIBLE WITH BASIC, AND CURSOR MOTION CONTROLS. CONSERVATIVE DESIGN PRINCIPLES HAVE BEEN USED THROUGHOUT TO RESULT IN A PRODUCT THAT IS EASY TO ASSEMBLE WITH FEW DISCRETE COMPONENTS, AND RELIABLE IN OPERATION.

THE PURPOSE OF THESE INSTRUCTIONS IS TO HELP YOU PRODUCE THE BEST RESULTS IN THE SHORTEST TIME WITH NO DAMAGE TO THE VARIOUS COMPONENTS.

IF THERE IS ANYTHING THAT YOU DO NOT UNDERSTAND, PLEASE DO NOT HESITATE TO CALL OR WRITE US!

AFTER COMPLETING THE ASSEMBLY, PLEASE FILL OUT AND RETURN THE WARRANTY CARD SO THAT WE CAN ADD YOU TO OUR MAILING LIST FOR FUTURE PRODUCTS.

IMPORTANT PRECAUTIONS

POWER MUST BE OFF WHEN:

INSERTING OR REMOVING BOARDS OR IC CHIPS
CONNECTING OR DISCONNECTING WIRES
SOLDERING

ONLY SOLDER WITH:

30 WATT MAXIMUM SOLDERING IRON
60/40 ROSIN CORE SOLDER

ALWAYS PROTECT MOS CHIPS FROM STATIC ELECTRICITY.

KIT CONTENTS FLASH WRITER

<u>QTY.</u>	<u>DESCRIPTION</u>
1	√PRINTED CIRCUIT BOARD
1	√6072 HEAT SINK
2	√7805/340T-5 REGULATOR
1	√78L12 REGULATOR
2	√8T97 (U55, U56)
2	√8097/74367 (U28, U29)
3	√74LS30 (U3, U50, U52)
4	√74LS02 (U6, U7, U10, U45)
3	√74LS00 (U11, U12, U32)
3	√74LS04 (U1, U13, U20)
3	√74LS14 (U51, U53, U44)
7	√74LS161 (U18,U19,U33-35,U46,U47)
1	√74LS175 (U31)
1	√74221 (U2)
2	√74166 (U4, U17)
1	√74S153 (U9)
12	√2102LHPC (U22-27, U37-42)
1	√74LS107 (U16)
1	√74LS32 (U5)
1	√74LS86 (U43)
1	√74LS08 (U54)
1	√7406 (U30)
1	√8212 (U14)

<u>QTY.</u>	<u>DESCRIPTION</u>
1	✓ MCM6574 (U8)
1	✓ IN5225B
4	✓ 74LS367 (U21, U36, U48, U49)
1	✓ 74LS20 (U15)
3	+✓ 470 PF 50 VOLT AXIAL GLASS CAPACITORS
3	✓ 4.0 MFD 50V AXIAL ELECTROLYTIC CAPACITOR
1	+✓ 100 MFD 16V AXIAL ELECTROLYTIC CAPACITOR
2	✓ 22 MFD 16V AXIAL ELECTROLYTIC CAPACITOR
5	+✓ .001 MFD 10V DISC CAPACITOR
19	+✓ 0.1 MFD 50V RADIAL CAPACITOR
1	+✓ 100 PF 10V DISC CAPACITOR
2	+✓ 150 OHMS 1/4 WATT CARBON RESISTORS (STRIPES OF BROWN, GREEN, BROWN)
2	+✓ 220 OHMS 1/4 WATT CARBON RESISTORS (STRIPES OF RED, RED, BROWN)
2	+✓ 330 OHMS 1/4 WATT CARBON RESISTORS (STRIPES OF ORANGE, ORANGE, BROWN)
3	+✓ 1K 1/4 WATT CARBON RESISTORS (STRIPES OF BROWN, BLACK, RED)
1	✓ 7.5K 1/4 WATT CARBON RESISTOR + (STRIPES OF VIOLET, GREEN, RED)
1	+✓ 4.7K WATT CARBON RESISTOR (STRIPES OF YELLOW, VIOLET, RED)
1	✓ 270 OHMS 1/4 WATT CARBON RESISTOR + (STRIPES OF RED, VIOLET, BROWN)
1	✓ 680 OHMS 1/4 WATT CARBON RESISTOR + (STRIPES OF BLUE, GRAY, BROWN)
1	+✓ 10K POTENTIOMETER
1	✓ 14.318 MHZ CRYSTAL

<u>QTY.</u>	<u>DESCRIPTION</u>
3	✓ 24 PIN SOCKETS
32	✓ 16 PIN SOCKETS
22	✓ 14 PIN SOCKETS
2	✓ EJECTORS, PINS
1	✓ MOLEX PLUG, 6 PIN
10" (APPROX)	✓ JUMPER WIRE, 30 GA.

ASSEMBLY INSTRUCTIONS

TOOLS AND MATERIALS REQUIRED FOR ASSEMBLY

THE FOLLOWING MINIMUM SET OF TOOLS AND MATERIALS IS REQUIRED FOR THE ASSEMBLY OF VECTOR GRAPHIC INC. KITS:

<u>DESCRIPTION</u>	<u>COMMENT</u>
VOLT-OHMMETER	INEXPENSIVE
SCREWDRIVER-STRAIGHT SLOT	FOR #5 AND #8 SCREWS
SCREWDRIVER-PHILLIPS HEAD*	FOR #8 SCREWS
CUTTERS-DIAGONAL	4", FLUSH CUTTING
PLIERS-NEEDLE NOSED	6"
PLIERS-REGULAR	MEDIUM
WIRE STRIPPER	FOR 8 AWG TO 20 AWG
SOLDERING IRON	30 WATTS MAXIMUM CHISEL TIP
SOLDER	.030 GA. 60/40 TIN-LEAD ROSIN CORE
SPONGE	FOR CLEANING SOLDERING IRON
PEN KNIFE	OR 'X-ACTO KNIFE
CLEANING SOLVENT	TRICHLORETHANE OR ISOPROPYL ALCOHOL. DO NOT USE ACETONE!
CARDBOARD	TO PROTECT TABLE TOP DURING SOLDERING
HEAT SINK GREASE	OR HIGH TEMPERATURE PLUMBERS GREASE
RULER*	TO MEASURE WIRE LENGTHS

* NOTE: REQUIRED FOR MAINFRAME CABINET ASSEMBLY ONLY.

SOLDERING TECHNIQUE

THE SOLDER

USE A #20 GAUGE (.030") ROSIN CORE SOLDER WITH A RATIO OF AT LEAST 60% TIN AND 40% LEAD. "KESTER" AND "ERSIN" ARE TWO DEPENDABLE BRANDS OF SOLDER. ACID CORE SOLDERS OR ACID FLUX MUST NOT BE USED AS THEY WILL CORRODE THE PRINTED CIRCUIT BOARD.

THE SOLDERING IRON

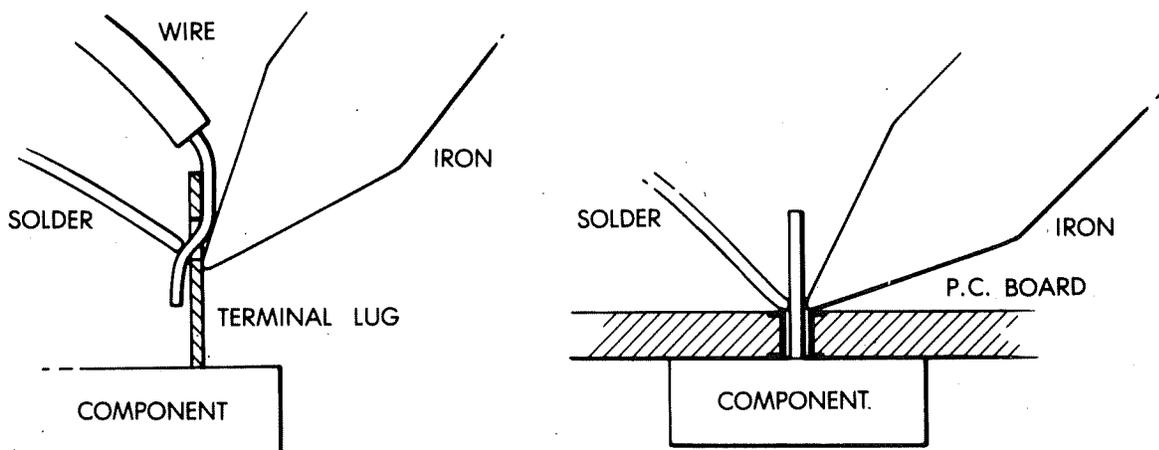
USE A SMALL, 30 WATT MAXIMUM IRON WITH A SMALL, CHISEL SHAPED TIP. TOO MUCH HEAT WILL DAMAGE BOTH COMPONENTS AND BOARDS. SOLDERING GUNS ARE TOO HOT AND SHOULD NOT BE USED.

HEAT THE IRON, WIPE ITS TIP QUICKLY ON THE DAMP SPONGE, AND APPLY A TINY AMOUNT OF SOLDER TO THE TIP - JUST ENOUGH TO MAKE IT SILVER IN COLOR BUT NOT SO MUCH THAT IT WILL DRIP OFF. THIS CLEANING PROCEDURE SHOULD BE REPEATED WHENEVER THE TIP OF THE SOLDERING IRON BEGINS TO TAKE ON A BROWNISH COLOR.

THE PROCEDURE

THE ENTIRE SOLDERING OPERATION SHOULD TAKE LITTLE MORE THAN TWO SECONDS PER JOINT. THE SEQUENCE IS AS FOLLOWS:

TOUCH THE TIP OF THE SOLDERING IRON TO THE JOINT, AS SHOWN BELOW, SO THAT BOTH CONDUCTORS TO BE JOINED ARE SIMULTANEOUSLY HEATED SUFFICIENTLY TO MELT THE SOLDER.



TOUCH THE SOLDER TO THE JOINT, AS SHOWN ABOVE, JUST LONG ENOUGH TO MELT ENOUGH SOLDER TO FORM A FILLET ON THE JOINT. TOO MUCH SOLDER MAY SHORT CIRCUIT THE BOTTOM OF THE BOARD OR FLOW THROUGH THE HOLES AND WICK INTO THE SOCKETS. THE

MELTED SOLDER WILL APPEAR WET AND SHINY. IT WILL QUICKLY FLOW COMPLETELY AROUND THE WIRE AND OVER THE SURFACE TO WHICH THE WIRE IS ATTACHED.

REMOVE THE SOLDERING IRON AS SOON AS BOTH SURFACES HAVE BEEN COMPLETELY WETTED. REMEMBER, THE TOTAL TIME FROM APPLICATION TO REMOVAL OF THE SOLDERING IRON SHOULD BE ONLY TWO OR THREE SECONDS. REMOVAL OF THE SOLDERING IRON TOO SOON MAY RESULT IN A COLD SOLDER JOINT AND LEAVING THE SOLDERING IRON IN CONTACT TOO LONG MAY CAUSE HEAT DAMAGE TO EITHER THE COMPONENTS OR THE BOARD.

REMOVAL OF MULTI-PIN SOLDERED-IN PARTS

CAUTION

IF FOR ANY REASON IT BECOMES NECESSARY TO REMOVE A SOLDERED-IN PART HAVING MORE THAN JUST TWO LEADS, DO NOT TRY TO REMOVE THE PART INTACT. IT CAN BE DONE, BUT ONLY WITH THE RISK OF DAMAGING THE PRINTED CIRCUIT BOARD IN THE PROCESS.

HOLD THE PRINTED CIRCUIT BOARD IN A PADDED VISE TO AVOID DAMAGE.

REMOVAL OF SOLDERED-IN IC SOCKETS

CAREFULLY PRY UP THE PLASTIC BODY OF THE SOCKET USING A KNIFE OR SCREWDRIVER TO LEAVE THE PINS EXPOSED. GENTLY REMOVE THE PINS FROM THE TOP OF THE BOARD WITH NEEDLE NOSED PLIERS WHILE TOUCHING THE JOINT ON THE OTHER SIDE OF THE BOARD WITH THE TIP OF THE IRON. DO NOT USE FORCE. THE PIN WILL COME OUT QUITE EASILY ONCE THE SOLDER MELTS.

CLEAR THE HOLES OF ANY EXCESS SOLDER USING A SOLDER SUCKER OR WICK.

REMOVAL OF SOLDERED-IN INTEGRATED CIRCUIT CHIPS

CUT EACH PIN WITH A PAIR OF DIAGONAL CUTTERS AT A POINT BETWEEN THE CHIP AND THE PRINTED CIRCUIT BOARD WHICH IS AS CLOSE TO THE CHIP AS POSSIBLE SO THAT THERE IS ENOUGH OF THE PIN SHOWING ABOVE THE BOARD TO BE GRASPED BY NEEDLE NOSED PLIERS WHILE REMOVING AS DESCRIBED ABOVE.

PREPARATION FOR ASSEMBLY

WORKING AREA AND TOOLS

A WELL-LIGHTED, CLEAN TABLE OR WORK BENCH AND THE PROPER TOOLS AND MATERIALS ARE MOST IMPORTANT FOR PRODUCING TROUBLE FREE ASSEMBLIES. THE WORK SURFACE SHOULD BE CLEAN AND FREE OF ALL ITEMS EXCEPT FOR THE TOOLS AND KIT COMPONENTS BEING USED. A CLEAN PIECE OF CARDBOARD OR HAND TOWEL IS SUGGESTED TO PROTECT THE TABLE TOP WHEN SOLDERING.

CHECK KIT CONTENTS

VERIFY THE CONTENTS OF YOUR KIT AGAINST THE KIT CONTENTS LIST IN FRONT OF THIS MANUAL. CHECK EACH PART VISUALLY FOR DAMAGE IN SHIPPING. IF THERE ARE ANY MISSING OR DAMAGED ITEMS, PLEASE NOTIFY THE DEALER FROM WHOM YOU BOUGHT YOUR KIT IMMEDIATELY. THERE MAY BE SLIGHT VARIATIONS FROM THE PARTS SPECIFIED, BUT THE COMPONENTS SHOULD BE FUNCTIONALLY EQUIVALENT.

PARTS LAYOUT AND ASSEMBLY SEQUENCE

THE FRONT OF THE BOARD IS THE SIDE ON WHICH THE PARTS LAYOUT HAS BEEN SILK SCREENED. ALL PARTS WILL BE ON THE FRONT OF THE PRINTED CIRCUIT BOARD. THEIR LEADS OR PINS WILL PASS THROUGH THE BOARD AND BE SOLDERED ON THE REAR.

PLACE THE BOARD WITH ITS FRONT SIDE UP AND THE GOLD EDGE CONTACTS NEAREST YOU. IN THAT POSITION, WE WILL REFER TO THE UPPER PORTION OF THE BOARD AS BEING FURTHEST AWAY FROM YOU.

SHOULD YOU USE SOCKETS?

WE RECOMMEND THE USE OF SOCKETS FOR TWO REASONS. ONE IS THAT SOLDERED-IN CHIPS CANNOT BE RETURNED FOR REPLACEMENT. ANOTHER IS THAT, SHOULD YOU HAVE TO REPLACE A CHIP, IT IS POSSIBLE TO DO CONSIDERABLE DAMAGE TO THE P.C. BOARD, UNLESS YOU ARE EXPERIENCED AT IC REMOVAL AND HAVE THE PROPER TOOLS.

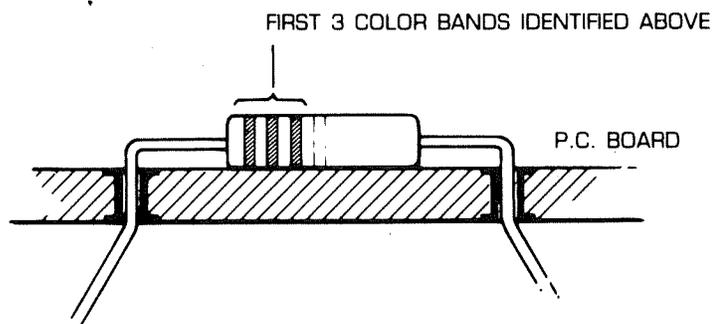
FLASH WRITER ASSEMBLY SEQUENCE

CHECKING THE PRINTED CIRCUIT BOARD

ALTHOUGH WE HAVE INSPECTED THE BOARD PRIOR TO SHIPMENT, A FURTHER ELECTRICAL CHECK FOR ETCH BRIDGES BETWEEN TRACES MAY BE PERFORMED WITH AN OHMMETER, USING THE LOW RESISTANCE RANGE.

RESISTORS

ORIENTATION IS OF NO CONCERN WITH RESISTORS, BUT BE SURE THAT THE STRIPED COLOR CODE WHICH IDENTIFIES THE RESISTANCE VALUE IS AS SHOWN ON THE COMPONENT DIAGRAM FOR THE PARTICULAR LOCATION.



INSERT THE LEADS INTO THE PROPER HOLES, HOLD THE RESISTOR BODY FIRMLY AGAINST THE BOARD, AND THEN SLIGHTLY SPREAD THE LEADS ON THE OPPOSITE SIDE OF THE BOARD TO HOLD IT IN PLACE WHILE SOLDERING.

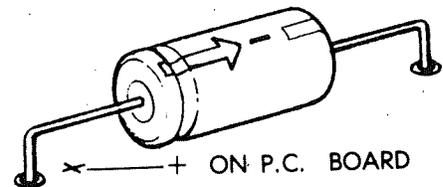
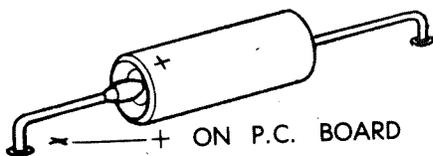
INSPECT FOR PROPER LOCATION AND FOR PROPER SOLDER JOINTS AND THEN CLIP OFF EXCESS LENGTH WITH DIAGONAL CUTTERS.

AXIAL GLASS CAPACITORS

AXIAL GLASS CAPACITORS HAVE NO SPECIAL POLARITY REQUIREMENTS. REFER TO THE COMPONENT DIAGRAM FOR PROPER LOCATION AND SOLDER IN PLACE AS DESCRIBED ABOVE FOR RESISTORS.

AXIAL ELECTROLYTIC CAPACITORS

AXIAL ELECTROLYTIC CAPACITORS HAVE SPECIAL POLARITY REQUIREMENTS, THE REVERSAL OF WHICH WILL CAUSE DAMAGE TO THE CAPACITOR. MOST SMALL, AXIAL ELECTROLYTICS WILL BE MARKED WITH A "+" AND/OR HAVE A GROOVE AT THE PLUS END. SOME HAVE AN ARROW POINTING TO THE OPPOSITE END WHICH IS "-". THE LEAD FROM THE "+" END IS TO BE INSERTED IN THE HOLE MARKED "+" ON THE PRINTED CIRCUIT BOARD. REFER TO THE COMPONENT DIAGRAM FOR PROPER LOCATION AND SOLDER AS DESCRIBED ABOVE FOR RESISTORS.



SOCKETS

CHECK THE PINS OF IC SOCKETS TO INSURE THAT NONE ARE MISSING AND THAT EACH IS IN LINE. IF THERE ARE ANY CONTACTS MISSING, THE SOCKET IS DEFECTIVE AND MUST BE REPLACED. IF ANY CONTACTS ARE OUT OF LINE, GENTLY STRAIGHTEN THEM WITH NEEDLE NOSED PLIERS.

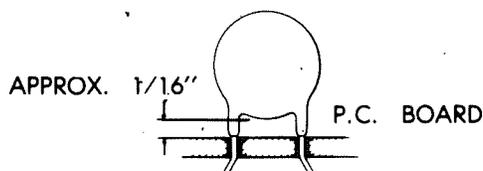
CAREFULLY INSERT EACH IC SOCKET IN ITS PROPER LOCATION MAKING SURE THAT ALL ITS PINS ENTER THEIR ASSIGNED HOLES SIMULTANEOUSLY TO AVOID BENDING. CHECK THE BACK OF THE BOARD TO INSURE THAT ALL THE PINS HAVE STARTED THROUGH. PRESS IN AND HOLD THE SOCKET FIRMLY AGAINST THE BOARD WHILE SOLDERING.

SOLDER THE DIAGONALLY OPPOSITE PINS OF THE SOCKET FIRST AND THEN HOLD THE BOARD UP TO THE LIGHT TO INSURE THAT EACH SOCKET IS FIRMLY SEATED. THEN SOLDER THE REMAINING PINS.

DO NOT INSERT IC CHIPS UNTIL AFTER ALL OTHER PARTS HAVE BEEN SOLDERED IN AND THE BOARD HAS BEEN CLEANED.

DISC CAPACITORS

DISC CAPACITORS DO NOT REQUIRE SPECIAL ORIENTATION. HOWEVER, THEY OFTEN HAVE THEIR COATING EXTENDING DOWN FROM THEIR BODY ALONG THEIR LEADS. IF TOO FAR ALONG THE LEAD, IT MAY BE CRACKED OFF BY SQUEEZING IT WITH PLIERS. IN ANY EVENT, BE SURE THAT THIS INSULATIVE COATING DOES NOT EXTEND INTO THE PRINTED CIRCUIT BOARD HOLE.



INSERT THE LEADS OF THE CAPACITORS THROUGH THE PROPER HOLES AS INDICATED ON THE PARTS LAYOUT. BEND THE LEADS SLIGHTLY OUTWARD TO HOLD THE CAPACITOR IN POSITION WHILE SOLDERING. THE CAPACITORS SHOULD BE SPACED UNIFORMLY ABOVE THE PRINTED CIRCUIT BOARD ABOUT 1/16" SO AS TO GIVE A NEAT APPEARANCE TO THE FINISHED BOARD. SOLDER IN PLACE WHILE HOLDING IN THIS POSITION. CLIP OFF EXCESS LEAD LENGTH WITH DIAGONAL CUTTER.

78L12 REGULATOR

REFER TO THE COMPONENT DIAGRAM FOR PROPER PLACEMENT. THE 78L12 REGULATOR SHOULD BE SO ORIENTED THAT THE FLAT EDGE OF THE REGULATOR POINTS TOWARD THE TOP OF THE BOARD. BEND THE LEADS TO FIT INTO THE PC HOLES AND SOLDER IN PLACE AS DESCRIBED ABOVE FOR DISC CAPACITORS.

! IMPORTANT !

CLEAN THE BOARD WITH A FLUX REMOVING SOLVENT BEFORE CONTINUING ASSEMBLY.

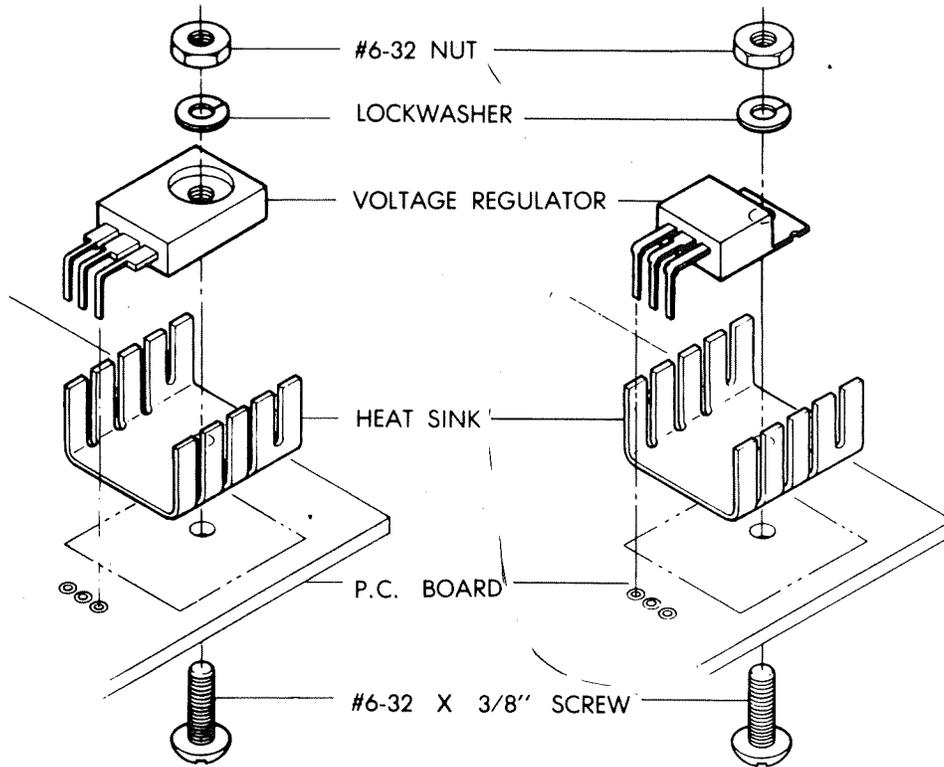
7805 REGULATOR AND HEATSINK

ASSEMBLE THE 7805 REGULATOR ON THE FRONT OF THE BOARD IN THE LOCATION NOTED ON THE PARTS LAYOUT.

1. INSERT THE 6-32X3/8" METAL SCREW FROM THE BACK OF THE PRINTED CIRCUIT BOARD.
2. APPLY A THIN COAT OF HEAT SINK GREASE OR PLUMBERS GREASE TO BOTH SIDES OF THE HEAT SINK. THIS WILL GREATLY IMPROVE THE CONDUCTION OF HEAT BETWEEN COMPONENTS.
3. PLACE THE HEAT SINK ON THE TOP OF THE BOARD OVER THE PROTRUDING SCREW.
4. PLACE THE VOLTAGE REGULATOR OVER THE SCREW WHILE CAREFULLY INSERTING ITS LEADS INTO THEIR PROPER HOLES.
5. PLACE THE LOCKWASHER OVER THE END OF THE SCREW AND FINALLY THE METAL NUT.
6. CAREFULLY TIGHTEN THE SCREW FROM THE BACK WITH A SCREWDRIVER WHILE HOLDING BOTH THE HEAT SINK TO INSURE THE PROPER ALIGNMENT AND THE REGULATOR TO PREVENT

ANY STRAIN ON THE LEADS CAUSED BY TURNING PRESSURE.

7. SOLDER THE LEADS ON THE BACK OF THE BOARD. INSPECT FOR PROPER SOLDER JOINTS AND THEN CLIP OFF EXCESS LEAD LENGTH WITH DIAGONAL CUTTERS.



TESTING THE REGULATORS

APPLY POWER TO THE BOARD BY PLUGGING IT INTO YOUR COMPUTER OR BY CONNECTING IT TO A SUITABLE POWER SUPPLY AND MEASURE THE REGULATED OUTPUT OF EACH REGULATOR. IF LESS THAN +4.75 VOLTS IS MEASURED, CHECK FOR A SHORT CIRCUIT.

CAUTION! SHORTED REGULATORS SOMETIMES EXPLODE -- STAY CLEAR OF THE REGULATOR SIDE OF THE BOARD WHILE TESTING IT.

IF MORE THAN +5.30 VOLTS IS MEASURED, THE REGULATOR SHOULD BE REPLACED.

POTENTIOMETER

THE POTENTIOMETER SHOULD BE SO ORIENTED THAT THE FLAT EDGE OF THE WHITE DISK POINTS TOWARD THE LOWER EDGE OF THE PC BOARD. REFER TO THE COMPONENT DIAGRAM FOR PROPER LOCATION AND BEND THE LEADS TO FIT INTO THE PC HOLES. SOLDER AS DESCRIBED ABOVE FOR DISC CAPACITORS.

CRYSTAL

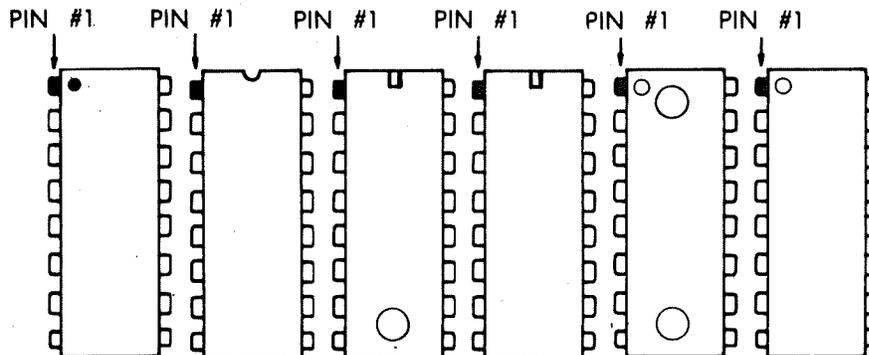
REFER TO THE COMPONENT DIAGRAM FOR PROPER PLACEMENT. INSERT THE LEADS THROUGH THE PC HOLES AND BEND THE BODY OF THE CRYSTAL FLAT TO THE BOARD. SPREAD THE LEADS SLIGHTLY TO HOLD IN PLACE WHILE SOLDERING. SOLDER IN PLACE AND CLIP THE EXCESS LEAD LENGTH WITH DIAGONAL CUTTERS.

THERE IS A PC HOLE ON EACH SIDE OF THE CRYSTAL FOR USE IN SOLDERING A RETAINING WIRE ACROSS THE CRYSTAL. WE RECOMMEND USING SUCH A STRAP TO PREVENT THE CRYSTAL FROM MOVING AND BREAKING THE LEADS.

ORIENTATION OF INTEGRATED CIRCUIT CHIPS

CARE MUST BE TAKEN TO INSURE THAT EACH INTEGRATED CIRCUIT CHIP IS SO ORIENTED, PRIOR TO INSERTION IN ITS SOCKET, THAT PIN #1 IS AT THE LOCATION SO DESIGNATED ON THE PRINTED CIRCUIT BOARD OR IN THE INDIVIDUAL ASSEMBLY INSTRUCTIONS FOR THE KIT.

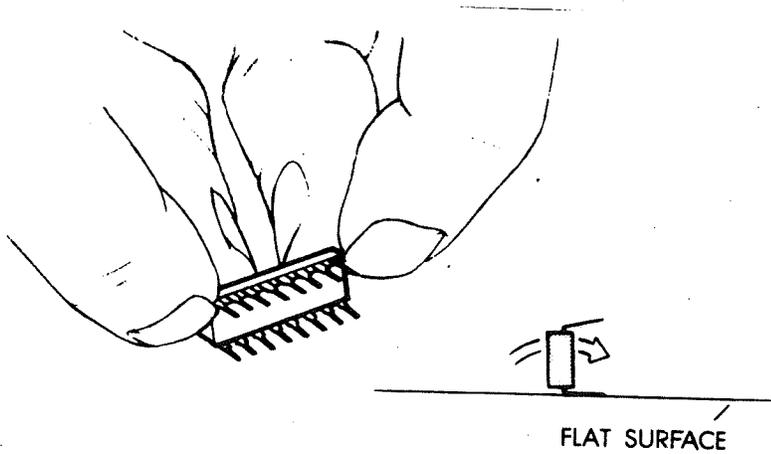
PIN #1 IS, UNFORTUNATELY, DESIGNATED IN A VARIETY OF WAYS DEPENDING UPON THE INTEGRATED CIRCUIT MANUFACTURER. SEVERAL METHODS ARE INDICATED IN THE DRAWING BELOW. WITH THE LEADS OF THE CHIP POINTING AWAY FROM THE VIEWER, PIN #1 IS IN THE POSITION INDICATED WITH RESPECT TO THE VARIOUS END NOTCHES OR TINY CIRCULAR MARKINGS OR DEPRESSIONS IN ONE CORNER.



INSERTION OF INTEGRATED CIRCUIT CHIPS

BE SURE ALL LEADS ARE STRAIGHT AND PARALLEL. IF NOT, GENTLY STRAIGHTEN AND ALIGN THE BENT PINS WITH NEEDLE NOSED PLIERS.

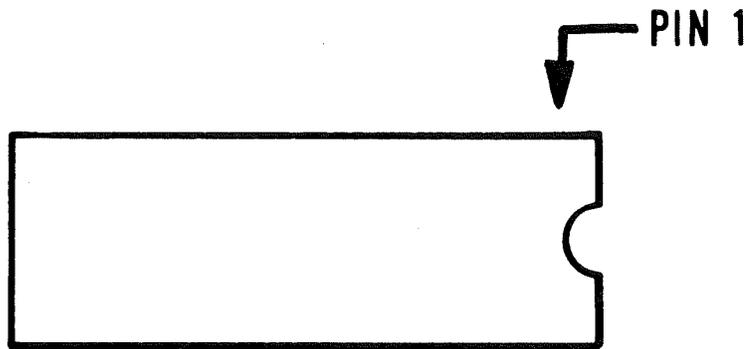
INTEGRATED CIRCUIT CHIPS USUALLY COME FROM THE MANUFACTURER WITH THEIR ROWS OF LEADS SPREAD WIDER THAN THE SOCKET. TO BEND THE PINS IN A UNIFORM MANNER, PLACE THE CHIP ON ITS SIDE ON A FLAT SURFACE SO THAT ONE ROW OF PINS IS FLAT AGAINST THE SURFACE AS SHOWN BELOW.



HOLDING EACH SIDE OF THE CHIP FIRMLY AGAINST THE FLAT SURFACE WITH BOTH HANDS, ROTATE IT A SHORT DISTANCE UNTIL THE PINS ARE BENT PERPENDICULAR TO THE BODY.

INSTALLING THE INTEGRATED CIRCUITS

REFERRING TO THE COMPONENT DIAGRAM, INSTALL THE IC'S IN THEIR PROPER SOCKETS. PIN #1 ORIENTATION IS INDICATED ON THE COMPONENT DIAGRAM AND THE SILKSCREEN BY A SEMI-CIRCULAR DEPRESSION AT ONE END OF THE CHIP.



BE SURE THAT PIN #1 ORIENTATION IS CORRECT AND THAT THE LEADS ARE NOT BENT. IT IS VERY EASY TO FOLD PINS UNDER WHILE INSTALLING THEM.

EJECTORS

EJECTORS HAVE BEEN PROVIDED FOR EASE IN REMOVING THE BOARD FROM YOUR COMPUTER.

INSTALL THE EJECTORS IN THE UPPER CORNERS OF THE BOARD, USING PLIERS TO INSERT THE SPLIT PINS.

MOLEX CONNECTOR

REFER TO THE USERS GUIDE SECTION OF THIS MANUAL FOR CONNECTION OF THE MOLEX CONNECTOR.

JUMPER WIRES

A SHORT PIECE OF 30 GA JUMPER WIRE HAS BEEN PROVIDED FOR CONNECTION OF SIGNALS ON THE CIRCUIT SIDE OF THE BOARD. (REFER TO E COMPONENT LAYOUT DIAGRAM) .

1. ON THE CIRCUIT SIDE OF THE BOARD ADD A JUMPER WIRE BETWEEN THE PAD MARKED A LOCATED UNDER U8.
2. ON THE CIRCUIT SIDE OF THE BOARD ADD A JUMPER WIRE BETWEEN THE PAD MARKED B LOCATED UNDER U8 TO THE PAD MARKED B LOCATED BETWEEN U10 AND U11.

THEORY OF OPERATION

THIS IS A COMPLEX CIRCUIT COMPRISED OF MANY INTERACTING LOGIC CHAINS. IF THE PRECEEDING LINK IN THE CHAIN IS NOT FUNCTIONING PROPERLY, LITTLE CAN BE LEARNED BY LOOKING AT THE WAVEFORMS OF A PARTICULAR CIRCUIT. THE ORIGIN OF ALL TIMING SIGNALS IS A 14.318 MHZ OSCILLATOR CONSISTING OF A CRYSTAL AND SEVERAL SECTIONS OF U1. THIS FREQUENCY IS FOUR TIMES THE TELEVISION COLOR SUBCARRIER. U33 IS A DIVIDE BY 10 STAGE WHICH IS PRESET TO 3 AND COUNTS TO 12 TO GENERATE A SYMMETRICAL MOST SIGNIFICANT OUTPUT TO SIMPLIFY DECODING OF THE GRAPHIC SYMBOLS. THIS COUNTER, LIKE MOST OF THE OTHERS USED ON THE BOARD, IS A SYNCHRONOUS COUNTER WHICH MEANS THAT ALL OUTPUTS CHANGE SIMULTANEOUSLY IN TIME WITH THE CLOCK INPUT (PIN 1) AND ALL INPUTS HAVE AN EFFECT ONLY AT THE RISING EDGE OF THE CLOCK. THIS ELIMINATES THE PROBLEM OF DECODING GLITCHES PREVALENT WITH LESS COMPLEX RIPPLE COUNTERS. THE 10 CLOCK CYCLES COUNTED OUT REPRESENT ONE CHARACTER CELL, OR THE TIME DURING WHICH A SINGLE CHARACTER IS DISPLAYED ON THE SCREEN. U34 AND U35 ARE CASCADED TO PROVIDE A COUNT OF 91 WITH A PERIOD OF 63.5 USEC, THE CORRECT PERIOD FOR THE TV HORIZONTAL SWEEP. DURING THE LAST 64 COUNTS, U35 PIN 12 GOES HI, AND THIS IS THE PERIOD DURING WHICH THE CHARACTERS ARE DISPLAYED ON THE SCREEN. AT THE END OF THIS TIME PIN 15 GOES HI, INITIATING A VARIABLE DELAY IN U2 WHICH GENERATES A 5 USEC HORIZONTAL SYNC PULSE WHICH IS COMBINED BY U43 WITH THE VERTICAL SYNC PULSE AND THE VIDEO FROM U30 PIN 8 TO FORM COMPOSITE VIDEO.

THE HORIZONTAL SYNC PULSE FROM U2 PIN 4 IS USED AS THE CLOCK FOR THE VERTICAL SYNC COUNTERS BEGINNING WITH U46. IN ORDER TO SIMPLIFY THE DECODING OF THE GRAPHIC ELEMENTS WHICH DIVIDE THE 15 LINE CHARACTER CELL INTO THREE ELEMENTS VERTICALLY, U46 FIRST DIVIDES BY 5 AND U47 THEN DIVIDES BY THREE. CONCURRENT WITH THIS, A STRAIGHT BINARY COUNT MUST BE GENERATED FOR THE CHARACTER GENERATOR ROW INPUTS. THIS IS ACCOMPLISHED BY PRESETTING U18 TO THE PROPER COUNT AT THE TOP OF EACH CHARACTER CELL. U19 AND A SECTION OF U16 COMBINE WITH U47 AND U46 TO FORM A COUNTER THAT OVERFLOWS AT A COUNT OF 262 GENERATING A 60 HZ VERTICAL SYNC PERIOD. THE COUNT SEQUENCE IS SUCH THAT THE CHARACTER DISPLAY OCCURS DURING THE FIRST 240 COUNTS, AND THE VERTICAL SYNC INTERVAL BEGINS IMMEDIATELY THEREAFTER. THE LOWER HALF OF U16 GENERATES A VERTICAL SYNC PULSE OF 5 LINES BEFORE BEING RESET BY U47 PIN 14. U16 PIN 3 IS COMBINED WITH THE HORIZONTAL SYNC IN U43.

SINCE THE DISPLAY IS 64 CHARACTERS BY 16 LINES AND BOTH THESE NUMBERS ARE BINARY POWERS, THEY CAN BE COMBINED TO GENERATE A BINARY ADDRESS FOR 1024 BYTES OF MEMORY. THE APPROPRIATE SIGNALS LABELLED CO-C9 ARE MULTIPLEXED BY U36, U21, U48, U49 WITH THE MICROPROCESSOR ADDRESS BUS TO SELECT ONE OF 1024 MEMORY LOCATIONS. TWELVE MEMORY CHIPS ARE USED ON THE BOARD COMPRISING A 1024X8 AND 1024X4 BLOCK AS FAR AS THE MIROCOMPUTER IS CONCERNED, BUT IT IS READ OUT AS 1024X12 WHEN ACCESSED BY THE SYNC CIRCUITRY. U55 AND U56 INTERFACE THE MEMORY TO THE BUS SO THAT IT CAN BE READ BY THE CPU. THE 12 OUTPUTS FROM MEMORY GENERATED WHILE THE SYNC CIRCUITRY SCANS IT SEQUENTIALLY ARE APPLIED TO U8, THE CHARACTER GENERATOR AND TO U9, THE MULTIPLEXER FOR THE GRAPHIC SYMBOLS. SINCE THE CHARACTER GENERATOR IS INHERENTLY A SLOW DEVICE, IT OUTPUTS THE 7 BITS NEEDED TO FORM THE DOTS IN ONE HORIZONTAL LINE OF A CHARACTER IN PARALLEL, AND THEY ARE CLOCKED INTO SHIFT REGISTERS U17 AND U4 FROM WHICH THEY ARE CLOCKED OUT AT THE 14.318 MHZ DOT CLOCK RATE. THE GRAPHIC SYMBOLS ARE DECODED BY U9 USING THE OUTPUTS OF U47 AND U33 TO SELECT THE APPROPRIATE MEMORY BITS.

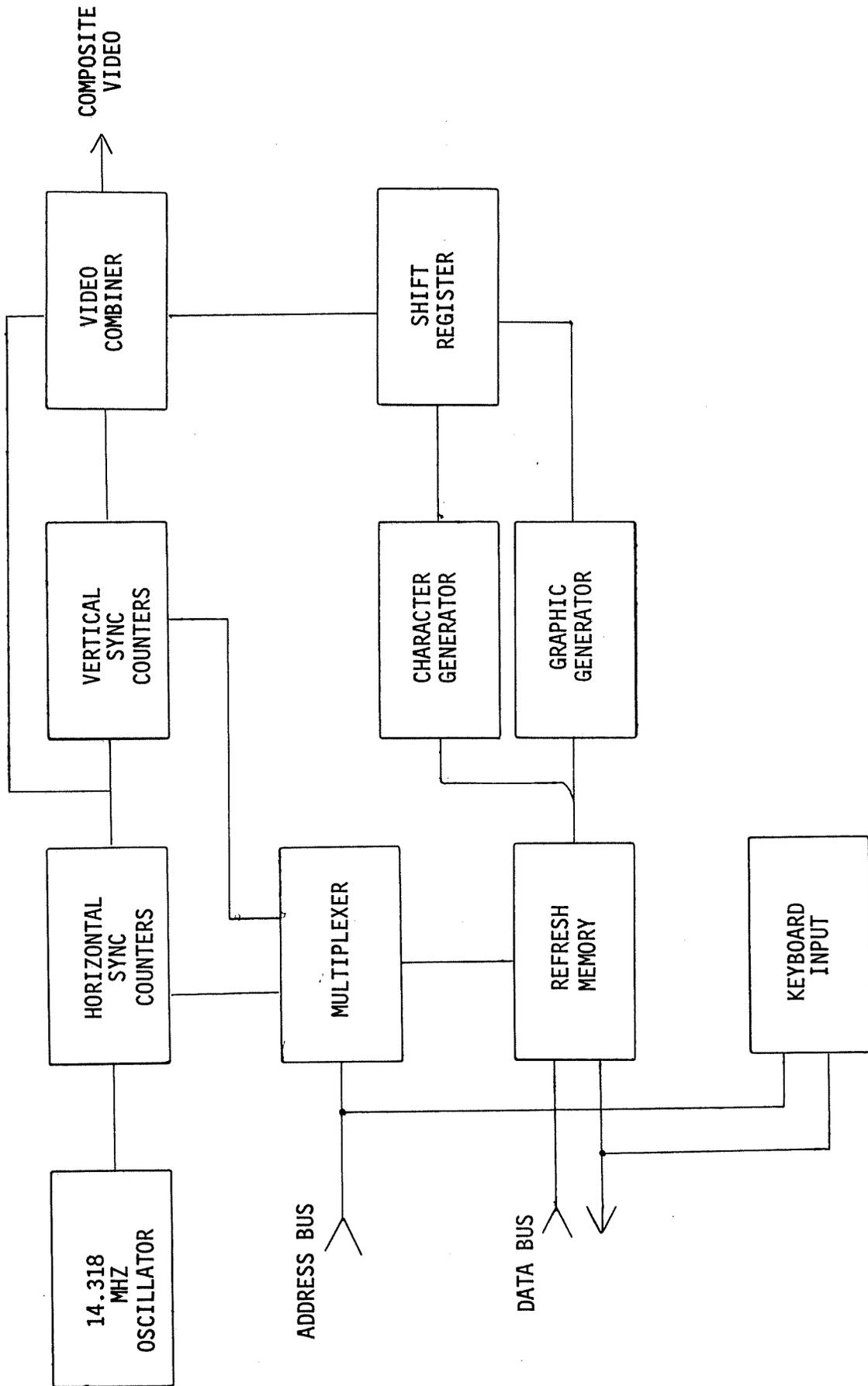
THESE SIGNALS ARE COMBINED IN U6 AND U7 WITH THE CHARACTER GENERATOR OUTPUTS. THE LEAST SIGNIFICANT BIT OF THE UPPER MEMORY BANK SELECTS EITHER GRAPHIC OR CHARACTER OUTPUTS BY ENABLING THE CHARACTER GENERATOR OR MULTIPLEXER THROUGH U5 AND SECTIONS OF U32.

SEPARATE VIDEO AND SYNC SIGNALS ARE PROVIDED FOR USE WITH MONITORS THAT REQUIRE THEM, SUCH AS THE BALL BROTHERS MONITOR MODEL TV-12. FOR USE WITH STANDARD MONITORS REQUIRING RS170 COMPOSITE VIDEO, U30, A HIGH CURRENT OPEN COLLECTOR INVERTER COMBINES THE SYNC AND VIDEO SIGNALS WITH A RESISTER NETWORK. THIS NETWORK PRODUCES 0.5 VOLTS OF SYNC AND ABOUT 1 VOLT OF VIDEO WITH AN OUTPUT IMPEDANCE WHICH MATCHES 75 OHM CO-AXIAL CABLE. THE RISE AND FALL TIME OF THE OUTPUT SIGNALS IS LESS THAN 20 NANoseconds, REPRESENTING A BANDWIDTH OF ABOUT 17 MHZ. SOME HIGH FREQUENCY PREEMPHASIS TO IMPROVE OPERATION WITH LIMITED BANDWIDTH DISPLAYS HAS BEEN PROVIDED BY SHUNTING THE 150 OHM RESISTOR WITH A 1000PF CAPACITOR.

THE ADDRESS OF THE REFRESH MEMORY IS DECODED BY U50 WHICH PRODUCES A BOARD ENABLE SIGNAL. ADDITIONAL LOGIC IS PROVIDED BY U10 TO ESTABLISH PRIORITY BETWEEN THE CPU ACCESS TO MEMORY AND THE SYNC COUNTER SCANNING OF MEMORY IN ORDER TO PREVENT GLITCHES ON THE SCREEN. DURING THE HORIZONTAL BLANKING INTERVAL, WHICH REPRESENTS ABOUT 25% OF THE TOTAL 63.5 MICROSECOND HORIZONTAL SWEEP TIME, THE CPU HAS PRIORITY. SHORTLY BEFORE THE ACTIVE DISPLAY PORTION OF THE SWEEP, THE CPU IS INHIBITED FROM ACCESSING MEMORY AND IS PUT IN A WAIT STATE UNTIL THE BLANKING INTERVAL. THIS RESULTS IN SOME REDUCTION IN THE SPEED AT WHICH THE CPU CAN UPDATE THE SCREEN MEMORY. A TYPICAL SOFTWARE LOOP TO WRITE ONTO THE SCREEN NORMALLY TAKES 30-40 MICROSECONDS WITH A 2 MHZ CLOCK. THE CPU IS SYNCHRONIZED TO THE HORIZONTAL SWEEP BY THE WAIT CIRCUITRY ON THE BOARD AND MAKES A TRANSFER EVERY 63.5 USEC. WITH A 4 MHZ CLOCK, TWO TRANSFERS CAN BE MADE EVERY 63.5 USEC. THIS IS MUCH FASTER THAN WAITING FOR THE VERTICAL RETRACE INTERVAL WHICH REDUCES THE TRANSFER RATE BY AS MUCH AS 90%. THE MEMORY BLOCK USED BY THE BOARD CAN BE SET AT ANY 2K BOUNDARY BY SELECTING THE APPROPRIATE JUMPERS TO U50, AND THE RELATIVE POSITION OF THE CHARACTER CODE MEMORY AND ATTRIBUTE MEMORY SELECTED BY THE JUMPER TO A10 OR A10. SINCE THE ATTRIBUTE MEMORY IS ONLY 4 BITS WIDE, THE CPU WILL READ THE FOUR MOST SIGNIFICANT BITS AS HIGH FOR ALL MEMORY LOCATIONS.

THE KEYBOARD INPUT PORT CONSISTING OF U14, U28, U52 IS LOGICALLY DISTINCT FROM THE VIDEO PORTION OF THE CIRCUIT. U14, AN 8212 8 BIT LATCH INPUTS PARALLEL DATA FROM A KEYBOARD CONNECTED TO J1 WHEN CLOCKED BY THE STROBE INPUT PIN 11. A JUMPER IS PROVIDED TO SELECT THE NORMAL POSITIVE GOING STROBE OR A NEGATIVE STROBE FROM THE KEYBOARD. A SERVICE REQUEST FLIP-FLOP IN THE 8212 IS SET WHEN A STROBE IS RECEIVED WHICH CAUSES PIN 23 TO GO LOW. THE MICROPROCESSOR INPUTS DATA BY FIRST TESTING THE STATUS PORT (EVEN) AND LOOKING AT THE PROPER BIT TO SEE IF A KEYBOARD STROBE HAS BEEN RECEIVED. IF SO, IT THEN READS THE DATA FROM THE DATA (ODD) PORT. THREE STATUS BITS ARE ACTUALLY PROVIDED; D10 HAS A LOW TRUE RDA BIT AND D16 HAS A HIGH TRUE RDA BIT. THESE BITS AND POLARITIES HAVE BEEN CHOSEN TO BE COMPATIBLE WITH MOST OF THE EXISTING SOFTWARE. AFTER THE CPU READS THE DATA PORT, THE STATUS BITS ARE RESTORED TO THE INACTIVES STATE. A THIRD STATUS BIT IS CONNECTED TO THE VERTICAL BLANKING SIGNAL, AND CAN BE USED BY SOFTWARE AS A REAL TIME CLOCK OR TO SYNCHRONIZE CHANGES ON THE SCREEN WITH THE VERTICAL RETRACE. THE ADDRESS OF THE KEYBOARD DATA AND STATUS PORTS IS SELECTED BY CONNECTING THE APPROPRIATE JUMPERS IN THE PATCH AREA NEXT TO U52.

FIGURE 1 FLASHWRITER BLOCK DIAGRAM



USERS GUIDE

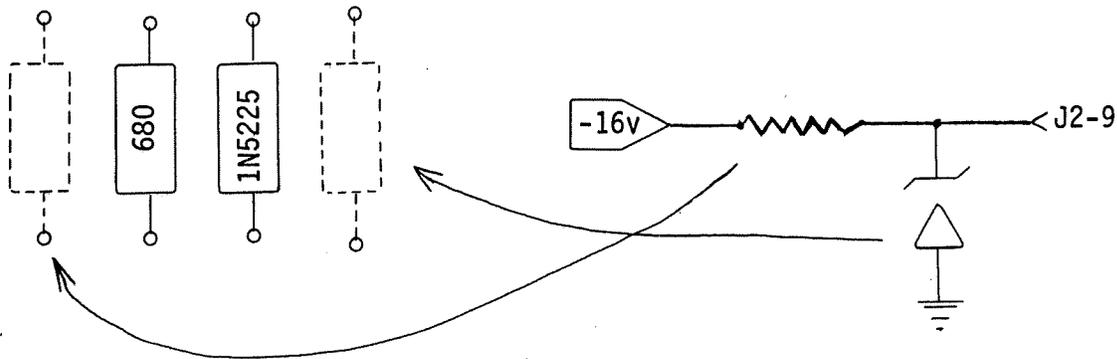
KEY BOARD PORT

INV 2
 NOR 3 1 TO LATCH

PAD 2 = INV = NEGATIVE (0V) KEYBOARD STROBE
 PAD 3 = NOR = POSITIVE (+5V) KEYBOARD STROBE

IF YOUR KEYBOARD HAS A POSITIVE TRUE STROBE JUMPER PADS 3 TO 1; IF YOUR KEYBOARD HAS A NEGATIVE TRUE STROBE JUMPER PADS 2 TO 1.

MANY KEYBOARDS REQUIRE A NEGATIVE VOLTAGE IN ADDITION TO THE +5V, AND THERE ARE PADS LOCATED IN THE LOWER CENTER PORTION OF THE BOARD FOR AN OPTIONAL ZENER REGULATER SUPPLY.



DATA 1
 DATA 3
 -V (OPT)
 PRESET
 STROBE

1	J1	24
2		23
3		22
4		21
5		20
6		19
7		18
8		17
9		16
10		15
11		14
12		13

VCC (+5V)
 DATA 5
 DATA 8
 DATA 2
 DATA 7
 DATA 6
 DATA 4
 GND

(24 PIN DIP)

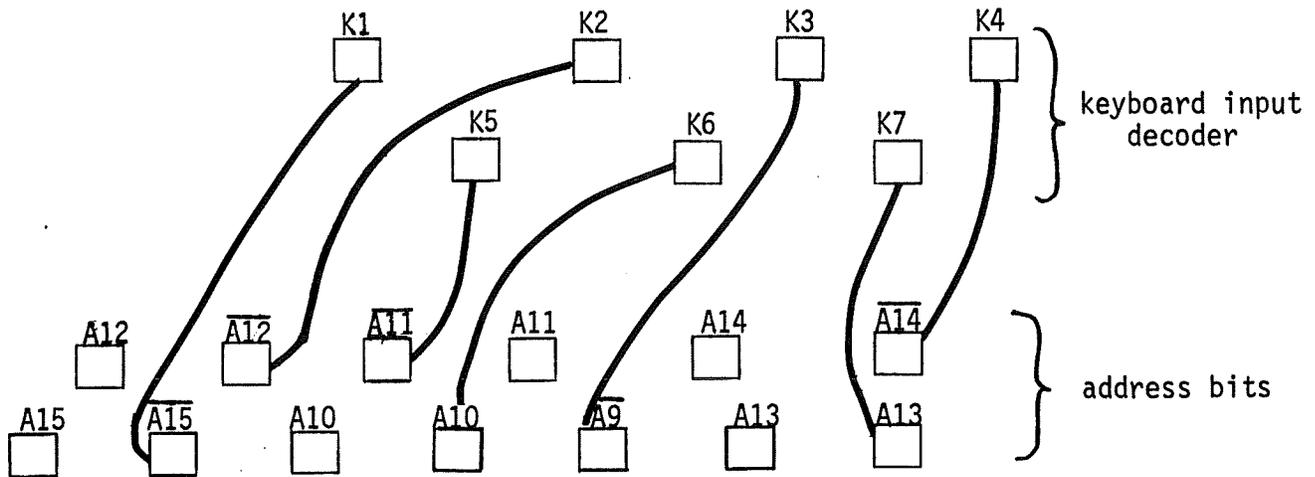
KEYBOARD I/O CONNECTOR

THE ZENER VOLTAGE WILL DEPEND ON THE KEYBOARD REQUIREMENTS IF IT IS NEEDED AT ALL, AND THE RESISTOR SHOULD BE SELECTED TO BIAS THE ZENER WITH AT LEAST 10 MA OF CURRENT IN ADDITION TO THE CURRENT REQUIRED BY THE KEYBOARD. FOR EXAMPLE, WITH A KEYBOARD REQUIRING 10 MA OF CURRENT AT 6V, THE ZENER COULD BE A IN752A (5.6V) AND THE RESISTOR COULD BE $10/.02=500$ OHMS (470 NOMINAL). THE ZENER POWER DISSIPATION WOULD BE 60 MW AND THE RESISTOR DISSIPATION WOULD BE 200 MW (USE A 1/2 WATT TO ALLOW FOR HIGHER SUPPLY VOLTAGES).

MOST KEYBOARDS HAVE EXTRA KEYS THAT ARE NOT CONNECTED TO THE ENCODER LOGIC, BUT MAY BE USED INDEPENDENTLY. IT IS CONVENIENT TO CONNECT ONE OF THESE KEYS TO MOMENTARILY GROUND PIN 75 ON THE BUS (PRESET) VIA PIN 11 ON J2 TO PERMIT JUMPING TO THE MONITOR IN THE VECTOR 1 WITHOUT USING THE RESET SWITCH ON THE FRONT PANEL.

KEYBOARD PORT ADDRESSING

THE KEYBOARD PORT IS PREJUMPED ON THE BOARD FOR PORTS 00H AND 01H. IF A DIFFERENT PORT ADDRESS IS REQUIRED IT MAY BE NECESSARY TO CUT ONE OR MORE CIRCUIT TRACES AND ADD APPROPRIATE JUMPERS.

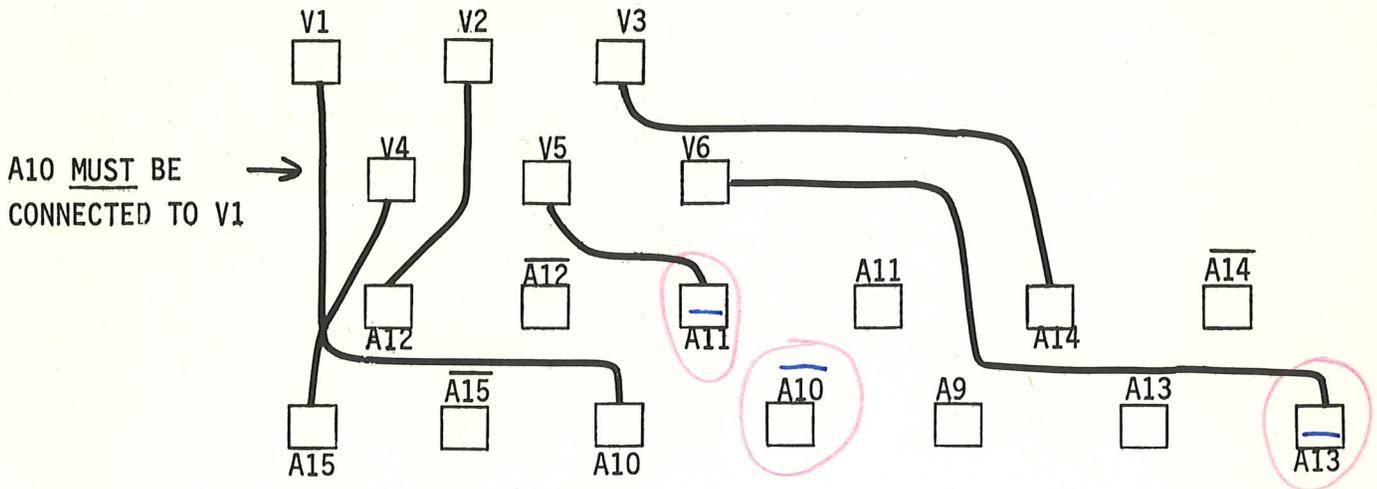


CIRCUIT TRACES AS MANUFACTURED

EXAMPLE: IF YOU NEEDED TO CHANGE THE KEYBOARD ADDRESS FROM 00H TO 10H THE TRACE FROM A12 TO K2 SHOULD BE CUT AND A JUMPER ADDRESSED FROM A12 TO K2.

VIDEO ADDRESSING

THE VIDEO DISPLAY PORTION OF THE FLASHWRITER ADDRESS IS ESTABLISHED BY JUMPER CONNECTIONS ON THE FRONT SIDE OF THE BOARD. IF YOUR BOARD WAS FACTORY ASSEMBLED AND TESTED, THE ADDRESS IS SET AT D000H. IF YOU PURCHASED THE FLASHWRITER IN KIT FORM, YOU MUST ADD THE JUMPERS.



JUMPERS FOR ADDRESS D000H

7	6	5	4	3	2	1	0	
ASCII CODES								D000H (typical)
ATTRIBUTES								D3FF D400
Reduced Intensity		Vert Lines		Horiz Lines		Graphics		D7FF

FLASH WRITER MEMORY MAP

GENERAL TROUBLE SHOOTING GUIDE

BECAUSE OF THE COMPLEXITY OF THE ENTIRE COMPUTER SYSTEM, BOTH HARDWARE AND SOFTWARE, IT IS ESSENTIAL TO ISOLATE ANY PROBLEM TO AN INDIVIDUAL BOARD OR PROGRAM. FORTUNATELY, ALL OF THE COMPUTER LOGIC IS ON EASILY REMOVABLE BOARDS. IT IS EXTREMELY VALUABLE TO HAVE ACCESS TO A TESTED COMPUTER SO THAT THE BOARDS CAN BE INDIVIDUALLY TESTED. ALTHOUGH THERE IS THE POSSIBILITY OF INTERACTION BETWEEN BOARDS DUE TO MARGINAL TIMING OR DEFECTIVE COMPONENTS, THIS IS NOT THE USUAL CASE, AND IT IS BEST TO ASSUME THAT IF A BOARD WORKS IN COMPUTER "A" IT WILL ALSO WORK IN COMPUTER "B".

THE MINIMUM SYSTEM CONSISTS OF THREE BOARDS: THE CPU BOARD, THE PROM/RAM BOARD, AND EITHER A VIDEO OR SERIAL I/O BOARD. MAKE SURE THAT THE MONITOR PROGRAM HAS BEEN PROPERLY PATCHED FOR THE PARTICULAR I/O CONFIGURATION OF YOUR SYSTEM. THERE IS TOTAL CONFUSION IN THE INDUSTRY CONCERNING PORT ASSIGNMENTS, LOGIC CONVENTIONS, AND STRAPPING OPTIONS. SEVERAL TYPES OF PROGRAMMABLE USARTS ARE USED WHICH REQUIRE INITIALIZATION.

IF YOU HAVE CAREFULLY FOLLOWED THE ASSEMBLY INSTRUCTIONS FOR EACH OF THE BOARDS AND THE REGULATORS CHECK OUT, INSTALL ALL CHIPS. LET'S ASSUME YOU ARE USING A VIDEO DISPLAY. AS SOON AS YOU TURN THE COMPUTER ON, YOU SHOULD SEE A DISPLAY OF RANDOM MEMORY GARBAGE ON THE TV SCREEN. THIS WILL BE INDEPENDENT OF ANY FUNCTIONING OF THE COMPUTER OTHER THAN THE CLOCK OSCILLATOR. IF YOU DO NOT GET A PROPER DISPLAY, THE VIDEO INTERFACE MUST BE DEBUGGED FIRST. FEEL THE CHIPS ON THE BOARD. ANY THAT ARE HOT TO THE TOUCH MAY BE IN BACKWARD (PROBABLY DESTROYED IF TTL) OR MAY HAVE THEIR OUTPUTS SHORTED. THERE IS MORE THAN A FACTOR OF TEN DIFFERENCE IN THE POWER DISSIPATION OF TTL CHIPS, BUT THEY SHOULD NOT BE UNCOMFORTABLY HOT TO THE TOUCH.

REMOVE THE BOARD AND INSPECT IT CAREFULLY. ABOUT HALF OF THE PROBLEMS CAN BE FOUND SIMPLY BY VISUAL INSPECTION. LOOK WITH A MAGNIFYING GLASS OR INSPECTION SCOPE AT EACH PIN ON THE BOTTOM FOR UNSOLDERED PINS, MISSING PINS THAT MAY BE BENT UNDER OR BROKEN OFF, SOLDER BRIDGES BETWEEN PINS OR TO ADJACENT TRACES, AND ETCH BRIDGES BETWEEN TRACES (VERY HARD TO SEE). A CAREFUL EXAMINATION WILL TAKE 15 MINUTES, BUT MAY SAVE YOU A LOT OF GRIEF, AND YOU MAY DISCOVER PROBLEMS LIKE UNSOLDERED PINS THAT MAY REVEAL THEMSELVES ONLY LATER AS INTERMITTENT PROBLEMS. EXAMINE THE TOP OF THE BOARD TO BE SURE THE PROPER CHIPS ARE INSTALLED IN THE RIGHT PLACES. SIGHT ALONG THE EDGE OF THE CHIPS TO FIND BENT UNDER PINS. CHIPS ARE SOMETIMES INSERTED WITH A WHOLE ROW OF PINS THAT MISS THE SOCKET HOLES.

IF THE VISUAL INSPECTION FAILS TO GET THE VIDEO DISPLAY WORKING, A COMPONENT MAY BE BAD (USUALLY AN IC). TRY EXCHANGING IDENTICAL COMPONENTS TO SEE IF THE SYMPTOMS CHANGE. AT THIS POINT IT IS WISE TO GO BACK AND CAREFULLY REREAD THE MANUAL TO BE SURE YOU UNDERSTAND THE WAY THE BOARD WORKS AND THAT YOU HAVE SELECTED THE PROPER JUMPER OPTIONS. AFTER THIS, YOU WILL PROBABLY WANT TO TAKE THE UNIT TO A DEALER IF YOU ARE NOT FAMILIAR WITH DIGITAL TROUBLE SHOOTING PROCEDURES, OR GO THROUGH THE CIRCUIT BLOCK BY BLOCK WITH A SCOPE OR LOGIC PROBE IF YOU ARE EXPERIENCED.

AFTER THE VIDEO DISPLAY OR SERIAL I/O IS WORKING, THE RESET SWITCH SHOULD CAUSE A "*" PROMPT TO BE WRITTEN. IF THIS DOES NOT WORK, FOLLOW THE SAME PROCEDURE ON THE CPU AND PROM/RAM BOARDS. THE CPU BOARD CONSISTS MOSTLY OF 8097 BUS DRIVERS

WHICH CAN BE EXCHANGED ONE BY ONE. THE VECTORED INTERRUPT AND REAL TIME CLOCK COMPONENTS, IC A1, ARE NOT NECESSARY IN THE BOARD AT THIS TIME AND SHOULD BE REMOVED. USING A SCOPE, EXAMINE THE OUTPUT PINS OF ALL CHIPS. LOW LOGIC LEVELS ARE NORMALLY LESS THAN 0.2 VOLTS AND HIGH GREATER THAN 3.0 VOLTS. A LEVEL OF 0.4 VOLTS MAY INDICATE SHORTS BETWEEN OUTPUTS WHERE ONE IS TRYING TO PULL HIGH AND THE OTHER LOW. A LEVEL OF 1.2 VOLTS INDICATES AN OPEN CIRCUITED INPUT. NMOS CHIPS HAVE SIMILAR LOGIC LEVELS, WHILE PMOS CHIPS CAN PULL TTL INPUTS TO -0.6V WHERE THE INPUT CLAMP DIODE LIMITS THE VOLTAGE. DO NOT BE SURPRISED AT HOW STRANGE SOME OF THE WAVEFORMS ON THE BUS LOOK, SUCH AS THE DI LINES. THERE ARE PERIODS OF TIME DURING WHICH THE BUS IS NOT BEING ACTIVELY DRIVEN, AND THE VOLTAGE MAY DRIFT DUE TO RECEIVER INPUT CURRENT. ABNORMAL OPERATION IS INDICATED PRINCIPALLY BY ABNORMAL LOGIC LEVELS MAINTAINED CONSTANT FOR AT LEAST ONE CLOCK PERIOD (500 MICROSECONDS).

ONCE YOUR BASIC SYSTEM IS WORKING, CHECK OUT OF MEMORY BOARDS AND OTHER INTERFACES IS RELATIVELY STRAIGHTFORWARD USING THE MEMORY TEST PROGRAM IN THE MONITOR, OR SIMPLE DIAGNOSTIC ROUTINES YOU CAN PROGRAM IN MEMORY ON THE PROM/RAM BOARD. AFTER YOUR SYSTEM IS UP AND RUNNING, IT SHOULD BE QUITE RELIABLE. SINCE MOST MICROCOMPUTER SYSTEMS ARE MEMORY INTENSIVE, THE MEMORY IS THE MOST LIKELY SOURCE OF COMPONENT FAILURE. A SYSTEM WITH 32K OF STATIC MEMORY MAY CONTAIN 75% OF ITS COMPONENTS ON THE MEMORY BOARDS. IF A PROBLEM IS EXPERIENCED RUNNING A PROGRAM, FIRST SUSPECT THE MEMORY AND USE THE MONITOR TEST PROGRAM. WE HAVE YET TO EXPERIENCE A PROBLEM WITH OUR 8K MEMORY BOARDS THAT WAS NOT REVEALED BY THE TEST PROGRAM. IF YOU DO MUCH REARRANGING OF YOUR SYSTEM, IT IS A GOOD PRACTICE TO TEST MEMORY FOR A FEW SECONDS WHEN YOU FIRST TURN ON THE COMPUTER TO MAKE SURE THE BOARDS ARE ADDRESSED PROPERLY OR THAT THEY ARE IN THE COMPUTER. THIS MAY SAVE SOME HEAD SCRATCHING WHEN THE PROGRAM YOU HAVE JUST LOADED FAILS TO RESPOND TO YOUR EAGER KEYBOARD TOUCH. IF YOU SUSPECT TEMPERATURE SENSITIVE CHIPS, REMOVE THE COVER OF THE COMPUTER TO INTERRUPT AIR FLOW BETWEEN BOARDS. WE DO NOT RECOMMEND OBSTRUCTING THE AIR FLOW THROUGH THE COMPUTER BY PLACING A SHEET OF PAPER OVER THE LEFT SIDE. A FULL COMPUTER MAY DISSIPATE OVER 300 WATTS AND REACH UNACCEPTABLE TEMPERATURES IF NO AIRFLOW IS PERMITTED.

STATEMENT OF WARRANTY

ALL COMPONENTS SOLD BY VECTOR GRAPHIC INC. ARE WARRANTEED FOR NINETY (90) DAYS AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS. DEFECTIVE PARTS WILL BE REPLACED AT NO CHARGE WHEN RETURNED POSTPAID TO VECTOR GRAPHIC WITHIN THE WARRANTY PERIOD.

ANY PRODUCT PURCHASED AS A KIT AND RETURNED POSTPAID WITHIN THE WARRANTY PERIOD, WHICH IN THE JUDGEMENT OF VECTOR GRAPHIC HAS BEEN ASSEMBLED WITH REASONABLE CARE AND NOT SUBJECTED TO MECHANICAL OR ELECTRICAL ABUSE, WILL BE REPAIRED AND RETURNED WITHOUT CHARGE. IF, IN THE JUDGEMENT OF VECTOR GRAPHIC THE KIT WAS NOT ASSEMBLED WITH REASONABLE CARE, THERE WILL BE A \$35.00 REPAIR CHARGE PER BOARD.

ANY PRODUCT PURCHASED AS A FACTORY ASSEMBLED UNIT IS WARRANTEED FOR 90 DAYS AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS. ALL FACTORY ASSEMBLED UNITS RETURNED POSTPAID TO VECTOR GRAPHIC WITHIN THE WARRANTY PERIOD WILL BE REPAIRED AND RETURNED WITHOUT CHARGE.

C700				0010	* SHORT FLASHWRITER VIDEO DRIVER *
C700				0020	* R.S.HARP 1/22/78
C700				0030	* FOR 1702A PROM/RAM BOARD *
C700				0040	*
C700				0050	PAGE EQU 0D000H
C700				0060	PSTAT EQU 0DOH
C700				0070	CURS EQU 0CFO0H
C700				0080	IFL EQU CURS+2
C700				0090	* POP PSW AND ENTER HERE *****
C700	F5			0100	VIDEO PUSH PSW
C701	C5			0110	PUSH B
C702	D5			0120	PUSH D
C703	E5			0130	PUSH H
C704	47			0140	MOV B,A
C705	3A	02	CF	0150	LDA IFL
C708	FE	20		0160	CPI 20H
C70A	C2	5B	C7	0170	JNZ CLRSC
C70D				0180	* DISPLAY A CHARACTER ON THE SCREEN *
C70D	2A	00	CF	0190	DISPL LHL D CURS
C710	36	20		0200	MVI M,20H
C712	78			0210	MOV A,B
C713	B7			0220	ORA A
C714	CA	6A	C7	0230	JZ DELAY
C717	FE	04		0240	CPI 4 (D) CLEAR SCREEN
C719	CA	5B	C7	0250	JZ CLRSC
C71C	FE	0A		0260	CPI 0AH (J) LINE FEED
C71E	CA	75	C7	0270	JZ LNFD
C721	FE	5F		0300	CPI 5FH UNDRLN BK SPCE
C723	CA	7C	C7	0310	JZ BKSPC
C726	FE	20		0312	CPI 20H CONTROL CHAR
C728	DA	6A	C7	0314	JC DELAY
C72B	E6	7F		0320	ANI 07FH
C72D	77			0330	MOV M,A
C72E	23			0340	INX H
C72F				0350	* MAKE SURE CURSOR IS ON THE SCREEN *
C72F	7C			0360	ONSCR MOV A,H
C730	FE	D4		0370	CPI PSTAT+4
C732	C2	51	C7	0380	JNZ RETRN
C735	21	00	D0	0390	LXI H,PAGE
C738	11	40	D0	0400	LXI D,PAGE+64
C73B				0410	* IF NOT, SCROLL UP ONE LINE *
C73B	1A			0420	SCROL LDAX D
C73C	77			0430	MOV M,A
C73D	13			0440	INX D
C73E	23			0450	INX H
C73F	7A			0460	MOV A,D
C740	FE	D4		0470	CPI PSTAT+4
C742	C2	3B	C7	0480	JNZ SCROL
C745				0490	* CLEAR THE LAST LINE *
C745	36	20		0500	CLRLN MVI M,020H
C747	23			0510	INX H
C748	7C			0520	MOV A,H
C749	FE	D4		0530	CPI PSTAT+4
C74B	C2	45	C7	0540	JNZ CLRLN

C74E 21 C0 D3	0550 LXI H,PAGE+960	
C751	0560 * RESTORE THE CURSOR AND RETURN *	
C751 36 A0	0570 RETRN MVI M,0A0H	
C753 22 00 CF	0580 SHLD CURS	
C756 E1	0590 POP H	
C757 D1	0600 POP D	
C758 C1	0610 POP B	
C759 F1	0620 POP PSW	
C75A C9	0630 RET	
C75B	0640 * CLEAR THE SCREEN *	
C75B 21 02 CF	0650 CLRSC LXI H,IFL	
C75E 36 20	0660 WRSPC MVI M,20H	SPACE
C760 23	0670 INX H	
C761 7C	0680 MOV A,H	
C762 FE D8	0690 CPI PSTAT+8	
C764 C2 5E C7	0700 JNZ WRSPC	
C767 C3 4E C7	0710 JMP RETRN-3	
C76A	0740 * FIXED DELAY ROUTINE *	
C76A 16 10	0750 DELAY MVI D,10H	
C76C 7A	0760 DLOOP MOV A,D	
C76D A7	0770 ANA A	
C76E 1B	0780 DCX D	
C76F C2 6C C7	0790 JNZ DLOOP	
C772 C3 51 C7	0800 JMP RETRN	
C775	0810 * LINE FEED *	
C775 11 40 00	0820 LNFD LXI D,64	
C778 19	0830 DAD D	
C779 C3 2F C7	0840 JMP ONSCR	
C77C	0850 * BACK SPACE *	
C77C 2B	0860 BKSPC DCX H	
C77D C3 51 C7	0870 JMP RETRN	
C780	0880 * KEYBOARD ECHO ROUTINE	
C780 CD DC C0	0890 ECHO CALL OCODCH	CONTROL C
C783 C4 00 C7	0900 CNZ VIDEO	
C786 C3 80 C7	0910 JMP ECHO	KEEP LOOPING
C789	0920 *	

SYMBOL TABLE

BKSPC C77C	CLRLN C745	CLRSC C75B	CURS CF00	DELAY C76A
DISPL C70D	DLOOP C76C	ECHO C780	IFL CF02	LNFD C775
ONSCR C72F	PAGE D000	PSTAT 00D0	RETRN C751	SCROL C73B
VIDEO C700	WRSPC C75E			

OPTION V VIDEO DRIVER FOR VDM-I AND SIMILAR VIDEO INTERFACES

The Option V video driver is branched to at C700H with the character code to be output in the accumulator. All registers are saved and restored, and the stack is not reinitialized. Six memory locations on the PROM/RAM board at CFDBH are used to store the cursor position, an initialization code, a reverse video flag, the character under the cursor, and a delay parameter. An initial call tests "IFL" for the code "I", and initializes the hardware scroll (port C8), reverse video flag, "SPD" and clears the screen, initializing the cursor position.

Control U, R, L and LF control the cursor position. To demonstrate these features, branch to the echo routine at C7F9 from the monitor with G C7F9. Although the monitor will echo any character, if it does not recognize it as a valid command, it prints CR, LF, '*'. Control N and O turn the reverse video off and on respectively, D clears the screen, H homes the cursor and shift O backspaces (not the same as Control L).

The video driver can be used by basic or other programs independently, by making minor changes to the output routine.

<u>FROM</u>	<u>TO</u>
OUTPUT IN 0	POP PSW
ANI 80H	JMP C700H
JNZ OUTPUT	(don't care)
POP PSW	
OUT I	
RET	



Note: Output = 04CD in 8K Basic V 3.1
= 06E1 in Extended V 3.2

No changes are needed to the VDM-1 board, but it must be jumpered for output port C8 and address D000H. The switch positions and address jumpers are diagrammed below.



Switch 3 is optional and controls the blinking cursor.

SPEED CONTROL

A controllable delay loop is used to vary the writing speed on the display, both with basic and with the monitor. Control S causes memory location "SPD" to be incremented from an initialized value to control the "delay" subroutine. This subroutine is branched to by either a NULL (00H) or carriage return (0DH). For use with the monitor, type Control S several times to slow down the display. For basic, type NULL X to change the delay. The value in "SPD" overflows after 7 Control S's to give zero delay. Control D initializes the value in "SPD" as well as clearing the screen.

If the cursor position in "CURS" gets bombed by a runaway program, the video driver may attempt to write in some random memory location not on the screen. This gives the operator the illusion that the CPU is in some hang up mode since "RESET" will not restore the Monitor prompt. If this happens, Control D will initialize the cursor position.

Any suggestions about improving the usefulness of this program would be appreciated.

C700		0010	* VIDEO DRIVER FOR VDM-1 TYPE DISPLAYS	
C700		0020	* SELF INITIALIZING VERSION	
C700		0030	* R.S.HARP 11/4/77	
C700		0040	*	
C700		0050	*	
C700		0060	*	
C700		0070	PAGE EQU ODOOOH	SCREEN LOCATION
C700		0080	PSTAT EQU ODOH	
C700		0090	CURS EQU OCFDBH	
C700		0095	IFL EQU CURS+2	
C700		0100	VFL EQU CURS+3	
C700		0110	UND EQU CURS+4	
C700		0120	SPD EQU CURS+5	
C700		0130	* POP PSW AND ENTER HERE	
C700		0140	*	
C700	F5	0150	VIDEO PUSH PSW	
C701	C5	0160	PUSH B	
C702	D5	0170	PUSH D	
C703	E5	0180	PUSH H	
C704	47	0190	MOV B,A	
C705	3A DD CF	0200	INIT LDA IFL	GET FLAG
C708	FE 49	0210	CPI 'I'	INITIALIZED?
C70A	CA 1F C7	0220	JZ DISPL	DISPLAY CHARACTER
C70D	AF	0225	INI XRA A	ZERO ACC
C70E	D3 C8	0227	OUT OC8H	ZERO SCROLL
C710	21 DD CF	0230	LXI H,IFL	
C713	36 49	0240	MVI M,'I'	SET IFL
C715	2C	0250	INR L	
C716	36 00	0260	MVI M,0	NORMAL VIDEO
C718	2C	0270	INR L	
C719	2C	0275	INR L	
C71A	36 20	0280	MVI M,32	
C71C	C3 BE C7	0350	JMP CLRSC	
C71F		0360	*	
C71F		0370	* VIDEO DRIVER CONTINUES HERE	
C71F		0380	*	
C71F	2A DB CF	0390	DISPL LHLD CURS	
C722	3A DF CF	0410	LDA UND	
C725	77	0420	MOV M,A	
C726	78	0430	MOV A,B	
C727	B7	0440	ORA A	
C728	CA D4 C7	0450	JZ DELY	DELAY TO SLOW SCROLL
C72B	FE 13	0452	CPI 13H	CTRL S SPEED
C72D	CA EE C7	0454	JZ INDEL	
C730	FE 15	0460	CPI 21	15H CURSOR UP
C732	CA A4 C7	0470	JZ UP	
C735	FE 12	0480	CPI 18	12H CURSOR RIGHT
C737	CA 6B C7	0490	JZ FORWD	
C73A	FE 0C	0500	CPI 12	0CH CURSOR LEFT
C73C	CA EA C7	0510	JZ CRSBK	
C73F	FE 0E	0520	CPI 14	0EH TOGGLE VIDEO
C741	CA B6 C7	0530	JZ GRON	
C744	FE 0F	0540	CPI 15	0FH REVERSE VIDEO
C746	CA B1 C7	0550	JZ GROFF	

C749	FE	04	0560	CPI	04	04H	CLEAR SCREEN
C74B	CA	0D C7	0570	JZ	INI		
C74E	FE	0A	0580	CPI	10	0AH	LINE FEED
C750	CA	E1 C7	0590	JZ	LNFD		
C753	FE	0D	0600	CPI	13	0DH	CTRL M RETURN
C755	CA	D0 C7	0610	JZ	CRTN		
C758	FE	08	0620	CPI	08	08H	CURSOR HOME
C75A	CA	CA C7	0630	JZ	HMCRS		
C75D	FE	5F	0640	CPI	95	5FH	BACK SPACE
C75F	CA	E8 C7	0650	JZ	BKSPC		
C762	E6	7F	0660	ANI	7FH		MASK MSB
C764	47		0670	MOV	B, A		SAVE A
C765	3A	DE CF	0680	LDA	VFL		LOAD FLAG
C768	B0		0710	ORA	B		SET MSB
C769	47		0730	MOV	B, A		
C76A	70		0740	MOV	M, B		
C76B	23		0750	FORWD INX	H		
C76C	7C		0760	ONSCR MOV	A, H		
C76D	FE	D4	0770	CPI	PSTAT+4		
C76F	C2	8E C7	0780	JNZ	RETRN		
C772	21	00 D0	0790	LXI	H, PAGE		
C775	11	40 D0	0810	LXI	D, PAGE+64		
C778	1A		0820	SCROL LDAX	D		
C779	77		0830	MOV	M, A		
C77A	13		0840	INX	D		
C77B	23		0850	INX	H		
C77C	7A		0860	MOV	A, D		
C77D	FE	D4	0870	CPI	PSTAT+4		
C77F	C2	78 C7	0890	JNZ	SCROL		
C782	36	20	0900	CLRLN MVI	M, 20H		WRITE SPACE
C784	23		0910	INX	H		
C785	7C		0920	MOV	A, H		
C786	FE	D4	0930	CPI	PSTAT+4		
C788	C2	82 C7	0940	JNZ	CLRLN		
C78B	21	C0 D3	0950	LXI	H, PAGE+960		
C78E	7E		0955	RETRN MOV	A, M		
C78F	32	DF CF	0960	STA	UND		
C792	F6	80	0970	ORI	80H		REVERSE VID CURSOR
C794	77		0990	MOV	M, A		
C795	22	DB CF	1000	SHLD	CURS		
C798	E1		1010	POP	H		
C799	D1		1020	POP	D		
C79A	C1		1030	POP	B		
C79B	F1		1040	POP	PSW		
C79C	C9		1050	RET			
C79D	3C		1060	DELAY INR	A		
C79E	C2	9D C7	1070	JNZ	DELAY		
C7A1	C3	8E C7	1080	JMP	RETRN		
C7A4	11	C0 FF	1090	UP LXI	D, -64		
C7A7	19		1100	DAD	D		
C7A8	7C		1110	FIX MOV	A, H		
C7A9	E6	03	1120	ANI	3		
C7AB	F6	D0	1130	ORI	PSTAT		
C7AD	67		1140	MOV	H, A		
C7AE	C3	8E C7	1150	JMP	RETRN		
C7B1	3E	80		GROFF MVI	A, 80H		

C7B3 C3 B8 C7
 C7B6 3E 00
 C7B8 32 DE CF
 C7BB C3 8E C7
 C7BE 21 00 D0
 C7C1 36 20
 C7C3 23
 C7C4 7C
 C7C5 FE D4
 C7C7 C2 C1 C7
 C7CA 21 00 D0
 C7CD C3 8E C7
 C7D0 7D
 C7D1 E6 C0
 C7D3 6F
 C7D4 3A E0 CF
 C7D7 57
 C7D8 7A
 C7D9 A7
 C7DA 1B
 C7DB C2 D8 C7
 C7DE C3 8E C7
 C7E1 11 40 00
 C7E4 19
 C7E5 C3 6C C7
 C7E8 36 20
 C7EA 2B
 C7EB C3 A8 C7
 C7EE 3A E0 CF
 C7F1 C6 20
 C7F3 32 E0 CF
 C7F6 C3 8E C7
 C7F9 CD 8B C0
 C7FC C3 F9 C7

1160 JMP SET
 1170 GRON MVI A,0
 1180 SET STA VFL
 1190 JMP RETRN
 1240 CLRSC LXI H,PAGE
 1260 WRSPC MVI M,20H
 1270 INX H
 1280 MOV A,H
 1290 CPI PSTAT+4
 1300 JNZ WRSPC
 1310 HMCRS LXI H,PAGE
 1320 JMP RETRN
 1330 CRTN MOV A,L
 1340 ANI OCOH
 1350 MOV L,A
 1351 DELY LDA SPD
 1352 MOV D,A
 1353 DLOOP MOV A,D
 1354 ANA A
 1355 DCX D
 1356 JNZ DLOOP
 1360 JMP RETRN
 1370 LNFD LXI D,64
 1380 DAD D
 1390 JMP ONSCR
 1400 BKSPC MVI M,20H
 1410 CRSBK DCX H
 1420 JMP FIX
 1430 INDEL LDA SPD
 1435 ADI 32
 1440 STA SPD
 1445 JMP RETRN
 1500 ECHO CALL OC08BH
 1520 JMP ECHO

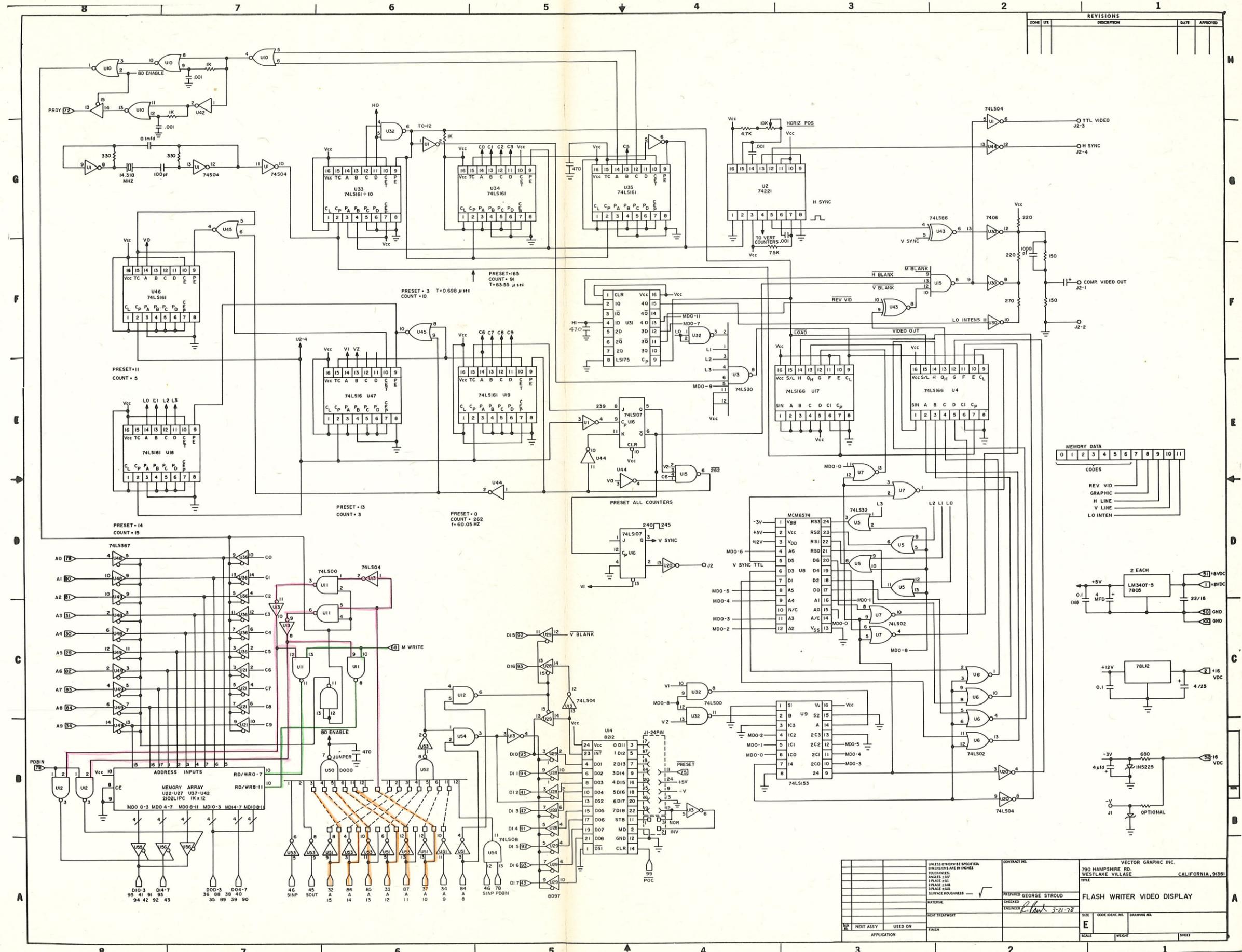
LOOK AT DELAY PARAM.

LOOK AT DELAY
 INCREMENT DELAY
 RESTORE DELAY

SYMBOL TABLE

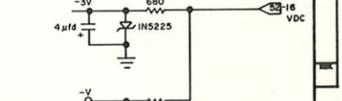
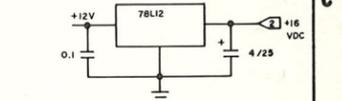
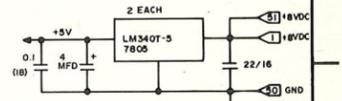
BKSPC C7E8	CLRLN C782	CLRSC C7BE	CRSBK C7EA	CRTN C7D0	CURS CFDB
DELAY C79D	DELY C7D4	DISPL C71F	DLOOP C7D8	ECHO C7F9	FIX C7A8
FORWD C76B	GROFF C7B1	GRON C7B6	HMCRS C7CA	IFL CFDD	INDEL C7EE
INI C70D	INIT C705	LNFD C7E1	ONSCR C76C	PAGE D000	PSTAT O0D0
RETRN C78E	SCROL C778	SET C7B8	SPD CFEO	UND CFDF	UP C7A4
VFL CFDE	VIDEO C700	WRSPC C7C1			

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REVISIONS				
ZONE	ITR	DESCRIPTION	DATE	APPROVED

MEMORY DATA											
0	1	2	3	4	5	6	7	8	9	10	11



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FINISHES ARE: ANGLE 88° HOLE 20 PLATE 200 SURFACE ROUGHNESS	CONTRACT NO. CHECKED ENGINEER DATE	VECTOR GRAPHIC INC. 790 HAMPSHIRE RD. WESTLAKE VILLAGE CALIFORNIA, 91361 TITLE FLASH WRITER VIDEO DISPLAY
APPLICATION	DATE	SCALE